Report on:
Status Review of Smalltooth Sawfish (*Pristis pectinata*) December 2000

Report compiled by: Dr Burke Hill, CSIRO Division of Marine Research, PO Box 120 Cleveland 4163, Australia

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Executive Summary of findings and recommendations

- The review is a thorough and comprehensive document that provides a balanced, comprehensive and adequate statement of the present situation regarding smalltooth sawfish in US waters.

Recommendation: That the review document be accepted as an adequate status review of smalltooth sawfish in terms of the Endangered Species Act

- The review shows a very large contraction in range of smalltooth sawfish. Present day distributions are effectively restricted to Florida with smalltooth sawfish rarely being encountered in other areas. Even in Florida the range is largely limited to the south. The review has shown that the U.S. population segment of smalltooth sawfish constitutes a DPS, or ``species,'' under the ESA. This DPS consists of a single population, with its current distribution centered in the Everglades Park (including Florida Bay).
- The two main factors that have contributed to this decline in population are unsustainable incidental capture by commercial fishing gear and loss or degradation of inshore habitat

Recommendation: That the determination by NMFS that smalltooth sawfish is in danger of extinction throughout all or a significant portion of its range be accepted and that the proposal by NMFS to list the U.S. DPS of smalltooth sawfish as endangered under the ESA at this time be accepted.

- The review shows there is a considerable body of legislation that could provide protection of smalltooth sawfish in US waters. Much of this legislation operates through general improvement in habitat or prevention of further degradation. The information provided in the review however shows that there is no current legislation that is aimed at protecting smalltooth population throughout its range in US waters. It is also clear from the review, that legislative arrangements in place have failed to protect smalltooth or halt a decline in population of smalltooth sawfish.

Recommendation: That if the proposed listing be made final, protective regulations under the ESA take effect, a recovery program be implemented, and critical habitat designated to protect the remaining population and habitat of smalltooth sawfish.

- Wildlife refuges of the type used in Florida are a most promising method of providing protection for smalltooth sawfish. Consideration needs to be given to the extent of area that is necessary to support a sustainable breeding population. There is also the potential problem of having only one relatively small protected population. In the longer term a recovery strategy needs to be developed that would possibly include reintroduction of smalltooth sawfish to formerly important habitats if these are still available.

Recommendation: The use of wildlife refuges is supported strongly for the protection of smalltooth sawfish but it is not clear if a single refuge in Florida will be adequate for long-term survival of the species.

- The review points out that the biological characteristics of sawfish make them particularly susceptible to exploitation as they have slow growth; relatively late maturity and they produce few young. However there is much biological data that are lacking and it is not possible to carry out a population assessment with the present information other than to say that the species is severely reduced from its former size.

Recommendation: That the biological program as proposed at the end of the review be implemented in order to provide a more adequate basis for short and long term management of smalltooth sawfish.

Background

Smalltooth sawfish are one of two species of sawfish found in US waters. The review focuses on smalltooth sawfish (*Pristis pectinata*). The second species, the largetooth sawfish, is presently not the subject of an Endangered Species Act (ESA) review. However it is likely that some measures to protect smalltooth sawfish will also be beneficial to largetooth sawfish.

As stated in the review, on November 30, 1999, NMFS received a petition from the Center for Marine Conservation requesting NMFS to list North American populations of smalltooth sawfish and largetooth sawfish as endangered under the ESA. The petitioner's request was based on four criteria:

(1) the present or threatened destruction, modification, or curtailment of its habitat or range;
(2) over utilization for commercial, recreational, scientific, or educational purposes;
(3) the inadequacy of existing regulatory mechanisms; and
(4) other natural or manmade factors affecting its continued existence.

A review of the status of a species is required by section 4(b)(1)(A) of the ESA whenever a listing petition is found to contain substantial information and consists of reviewing all

the available information on a species to determine if protection under the ESA is warranted. On March 10, 2000, NMFS published its determination that the petition presented substantial information indicating that listing may be warranted for smalltooth sawfish, and announced the initiation of a smalltooth sawfish formal status review (65 FR 12959).

NMFS appointed a status review team to investigate the status of smalltooth sawfish with regard to the listing criteria provided by the ESA. This review has been completed and submitted to external peer reviewers for comment.

As one of the external peer reviewers I have read the review and also some of the more important references. I have considered the information presented and used this as well as my personal knowledge of sawfish gained in northern Australia to evaluate the evidence presented by the review committee. My conclusions are presented below with respect to each of the four criteria required to be addressed by the review.

Review Activities

18 July 2001:	Notified of selection by steering committee as one of the reviewers on the sawfish review
1 August 2001:	Received copy of review Started reading review (0.5 days)
3 August 2001	Reading review and analyzing data, ordered select references from library (1 day)
6 August 2001	Reading review and consulting selected references (1 day)
7 August 2001	Reading review, consulting selected references and start compiling report (1 day)
8 August 2001	Completion of report (0.5 day)

Total Time on project: 4 days

Summary of findings

Sawfish are large marine elasmobranchs. They have a slow growth rate, relatively delayed sexual maturity – probably around 10 years of age – and the production of relatively few offspring (10 to 20) possibly only every second year. They are long-lived animals with a lifespan of probably 30 years. These biological characteristics combine to make sawfish vulnerable to increased mortality of adults or juveniles; they are not able to rapidly increase their population.

Smalltooth sawfish live in shallow inshore waters even into shallow estuaries, an unexpected habitat for such large animals. In this environment they have few if any predators especially as adults. Historical records indicate that despite their conservative biological characters, sawfish attained relatively large populations. As pointed out by the review, these populations no longer exist.

Decline in population size and range of smalltooth sawfish

The Status review discusses the geographical range of smalltooth sawfish with respect to three areas – the east coast of the US, Florida and the Gulf coast of the US. Historical records show that smalltooth sawfish have been recorded along much of the Atlantic coast of the US as far north as New York but that their occurrence has declined sharply in the last 50 to 100 years.

The review shows that smalltooth sawfish were also formerly common on the Gulf coast. As recently as 1953 there were reported as abundant in Texas waters. Subsequently however there appears to have been a major decrease – almost a collapse in smalltooth sawfish populations. The review points out that there have been only three records for the region since 1971.

The review indicates that the only significant population of smalltooth sawfish now occurring in the US is in southern Florida in the Everglades, Florida Keys and Dry Tortugas.

Conclusion: The review has adequately demonstrated that there has been a dramatic decline in numbers and distribution of smalltooth sawfish in US waters. The species is now effectively limited to southern Florida.

Causes of declines in smalltooth sawfish populations

The review proposes that the two main reasons for declines in smalltooth sawfish populations are unsustainable catches in commercial fishing gear, and the loss of inshore habitat formerly occupied by smalltooth sawfish.

The review presents data on captures of smalltooth sawfish by commercial fishing gear (Appendix C). These demonstrate that trawl gear is responsible for the overwhelming majority of reported cases – see below in the section headed: (B) over utilization for commercial, recreational, scientific, or educational purposes.

The review also establishes that there has been a substantial loss of habitat for smalltooth sawfish throughout southeastern US. The causes of this loss are agriculture, urban development, commercial activities, channel dredging, boating activities, and the diversion of freshwater run-off.

Conclusion: The review has presented a convincing case for the main causes of declines of smalltooth populations having been a large loss or degradation in their habitat as well as incidental capture in commercial fishing gear especially trawls. We cannot quantify the relative contribution of these main causes although in this reviewer's opinion it appears likely that loss of habitat may have a more widespread and long-lasting effect that cannot easily be mitigated.

Analysis of Listing Factors

(A) The present or threatened destruction, modification, or curtailment of its habitat or range

Smalltooth sawfish in common with most species of sawfish live in relatively shallow water including estuaries and coastal swamps. Thus inshore shallow regions are a critical habitat for this species. The review shows that these habitats have been extensively modified throughout the range and former range of smalltooth sawfish. The review nominates the following processes as being involved:

- Agriculture – wetland conversion, eutrophication, increased turbidity and sedimentation. 'Agriculture accounted for 87% of all wetland losses in the US between the mid-1950's and mid-1970's.'
- Urban development – wetland loss through filling for urban and suburban development, input of toxins and eutrophication
- Commercial activities – loss of habitat due to dredging and filling, non-point and point source pollution
- Channel dredging
- Boating – pollutants, construction of marinas
- Diversion of freshwater runoff – construction of canals

Conclusion: The reviewers have demonstrated clearly that the major reason for the decline of the US population of smalltooth sawfish population is the massive loss and degradation of habitat suitable for the species. Their conclusion is repeated here:
The U.S. DPS (Distinct Population Segment) of smalltooth sawfish has experienced a ninety percent curtailment of its range and severe declines in abundance. Agriculture, urban development, commercial activities, channel dredging, boating activities, and the diversion of freshwater run-off have resulted in the destruction and modification of smalltooth habitat throughout the southeastern U.S. Increases in coastal human populations will likely result in additional losses of marine habitats and increased pollution, further threatening the survival of smalltooth sawfish.

(B) Over utilization for commercial, recreational, scientific, or educational purposes;

The review correctly points out that a major source of mortality of sawfish is through incidental capture in commercial fishing gear. Appendix C supplied by the review committee lists NMFS sawfish records caught in commercial fishing gear in Florida, Louisiana and Texas between 1950 and 1978. Unfortunately numbers of sawfish are not available, the records are in weights. Analysis of this weight data shows the following percentage capture by the various forms of fishing gear:

Gear	% capture
Trawls, unspecified	70%
Otter trawl, bottom, shrimp	17%
Otter trawl, bottom, fish	5%
Trammel nets	5%
Haul Seines, Beach	3%
Lines Hand, Other	0%

Clearly trawls are the main source of reported catches, they accounted for 92% of the records by weight. Sawfish are regarded as a nuisance in trawl fisheries because they are difficult and often dangerous to remove from nets. The review also presents data collected by Simpfendorfer (2000) showing drastic reductions in the total weight of sawfish caught by shrimp trawlers off Louisiana from 1949 to 1978 despite a substantial increase in fishing effort over this period. Landings per unit effort in the 1970's were less than 1% of those in the 1950's. There are two obvious explanations for this catastrophic decline. Firstly changes in fishing practices including the introduction of TEDs. While it is possible that TEDs might have led to a reduced take of sawfish, no evidence is presented to support this possibility. The alternative explanation is that there has been a major decline in sawfish populations. Given the reduction in the distribution of smalltooth sawfish in the Gulf described above, this is the more likely explanation.

According to the review, the commercial fishing industry in the US has made little use of smalltooth sawfish. This is in contrast to other regions. An Audubon website on sawfish (www.audubon.org/campaign/lo/ow/sawfish, July 2001) points out that sawfish parts have been traded for centuries, long before monitoring or regulation existed. Worldwide, the sawfish's tooth-studded saw is valued as a trophy and sold in tourist shops as a curio. Saws collected in Malaysia are sent to China for use in traditional medicine. Sawfish skins, fins, and meat from all over the world enter Asian markets for use in medicines and fin soup. The liver oil of sawfish is sold internationally for use in cosmetics, medicines, lubricants and soap.

It appears that the US recreational fishery probably takes few sawfish. The banning of the possession of smalltooth sawfish in Florida has probably assisted in reducing the take by recreational anglers.

The review addresses the matter of keeping of sawfish in aquaria. While the overall number of sawfish in captivity is small, prices offered for live sawfish are very high – the review quotes $1000 per foot. Requests to NMFS for permits to catch live smalltooth sawfish for aquaria quote unrealistically high numbers of sawfish the status of smalltooth sawfish and might constitute a threat if acceded to.

Conclusion: The data presented in the review supports the conclusion that a contributory cause of the decline in smalltooth sawfish abundance has been bycatch in various fisheries but mainly in trawl fisheries. The decline in catches of smalltooth sawfish at a time when fishing effort increased is typical of an over fishing situation. The lack of any appreciable exploitation of smalltooth sawfish except recently as aquarium exhibits indicates that commercial exploitation has not caused the decline. It is unlikely that any scientific purpose has contributed to the decline.

(C) Disease or predation;

The review reports no evidence of competition, predation or disease as being involved in the decline of smalltooth sawfish. This is supported by an apparent lack of published records of these factors as influencing smalltooth sawfish. Their absence does not however mean that these factors have not played a part in the decline. It is possible for example that increasing levels of pollution might lead to increased susceptibility to disease as happens in some other species of fish.

Conclusion: The review has not identified any effect of disease or predation on smalltooth sawfish but it is recognized that there is a lack of information on these biological factors.

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(D) An analysis of Existing Regulatory Authorities, Laws and Policies and their Inadequacy to protect Smalltooth sawfish

CITES

The situation with respect to CITES is clear and it is unlikely that regulations under CITES can be used to protect smalltooth sawfish because there is no recorded international trade in this species.

Magnuson-Stevens Act

Although the review implies little protection under this act, I believe we can be a little more optimistic. The review states (p 25) that the majority of the seasonal closures and the permanent closures to shrimp trawling in the Gulf of Mexico are offshore of the areas where sawfish are more commonly found and thus may provide only limited benefit for this species. However it is important to note that smalltooth sawfish occur in these offshore areas as well as inshore and so offshore protection is important. Appendix A for example gives depth records for 15 sawfish. Eight of these were caught at depths greater than 20 m and the mean depth was 29 m. Two records from 1999 were for depths greater than 50 m. Additionally, data in Appendix C shows that over 90% of smalltooth sawfish captured in commercial gear were caught by trawls. It is accepted that this data is biased because trawling does not occur equally across all depths, nevertheless the fact that smalltooth sawfish do occur in relatively deep water should not be overlooked, for example it may be important at some stage of the life cycle.

Unfortunately the NMFS records in Appendix C do not include numbers, only gross weight. Several of the records are for tons of sawfish and so probably include more than one animal. Overall I feel that closures to shrimp trawling are beneficial in providing additional protection to smalltooth sawfish although of course closure are likely to be unpopular with the trawl industry who could justifiably point to habitat loss as a possibly greater cause of decline.

Lacey Act of 1981
The record of no Lacey Act cases, seizures etc. involving sawfish indicates that this Act is probably of little value in protecting smalltooth sawfish.

Endangered species Act of 1973
Unpublished and preliminary data on the effectiveness of TEDs in shrimp trawls in Australia indicates that TEDs reduce the catch rates of sawfish (CSIRO, Australia). Smaller individuals are more likely to pass through the TED. If this is the case for smalltooth sawfish in US waters, additional protection could be offered to smalltooth sawfish under this Act.

Fish and Wildlife Coordination Act
This Act does offer the opportunity to protect smalltooth sawfish by reducing habitat loss. Unfortunately much of the habitat suitable for smalltooth sawfish habitat has already been lost and it is not clear whether it will be possible to reclaim any of this habitat for a recovery plan. This means that it may not be an effective contributor to a recovery strategy for smalltooth sawfish other than attempting to freeze the status quo position.

Marine Protection, Research and Sanctuaries Act of 1972
Theoretically smalltooth sawfish could receive protection from MPAs but at this stage with the possible exception of indirect benefits from the Florida Keys National Marine Sanctuary, there appears to be no concrete example of the use of the Act being applied for this purpose.

Federal Water Pollution Control Act of 1972
The intent of this Act may indirectly provide some habitat protection to smalltooth sawfish. However as with the other Acts, there is no concrete example of the application of the Act to protect smalltooth sawfish.

National Environmental Policy Act of 1969
The intent of this Act may indirectly provide some habitat protection to smalltooth sawfish. However as with the other Acts, there is no concrete example of the application of the Act to protect smalltooth sawfish.

Coastal Zone Management Act
The intent of this Act may indirectly provide some habitat protection to smalltooth sawfish. However as with the other Acts, there is no concrete example of the application of the Act to protect smalltooth sawfish.

Federal Land Management and Other Protective Designations
National Wildlife Refuges offer an excellent way of providing protection to smalltooth sawfish along with other biota with similar requirements. As pointed out in the review, the fact that the present distribution of smalltooth sawfish is primarily within protected areas is encouraging. However it also raises the question of whether an increase in protected areas might lead to an increase in the smalltooth sawfish population and distribution.

STATE AUTHORITIES/LAWS
The review rightly points out that it is more effective to restrict the use of gear that catches sawfish than to allow the gear and to ban taking of sawfish. Unpublished data from Australia indicates that around 75% of sawfish returned to the water after capture in shrimp trawls are already dead (CSIRO Australia). It is likely that a proportion of those returned 'alive' would in fact die subsequently. Thus the mortality from the gear mostly involved in catching smalltooth sawfish in US waters probably also causes considerable mortality to smalltooth sawfish even if they are not taken.
It is encouraging to see that several states have or are implementing measures that should reduce impacts on smalltooth sawfish. Smalltooth sawfish are still found in the Everglades National Park and this is probably the most crucial element in ensuring the survival of the species in the US.

Conclusion: The Summary and Evaluation provided by the Review document is largely supported by the information provided on legislation and its adequacy to protect smalltooth sawfish. Although there is a wide range of laws and regulations that could be used, there is no evidence of the application of many of these to protect smalltooth sawfish. The major exception is the provision of National Wildlife Refuges; these can provide substantial protection. It is possible that greater enforcement of existing laws could materially assist smalltooth sawfish but at present most federal and state laws, regulations and policies are not doing so. If greater commitment to effective implementation of existing laws and regulations is not effective, then new laws would be needed. The problem with this approach unfortunately is that we do not have much time.

Other Natural or Manmade Factors Affecting Its Continued Existence

The data presented on life history characteristics support the conclusion that recovery of smalltooth sawfish populations will be a very slow process. Smalltooth sawfish have characteristics that make them unsuited for exploitation. They are slow growing, appear to only become sexually mature when they are around 10 years old and have a relatively small number of young. Sawfish generally have few predators and so before humans introduced effective catching methods, their populations were sustainable despite their biological characters.

Current Conservation Efforts

The activities described in the review under this heading all appear to be worthwhile and should continue. The Scientific Data and Research Needs section needs careful assessment to ensure that data gained is not at the expense of smalltooth sawfish populations. Particular items of concern are:

- *Noninvasive methods to determine maturity of captured specimens need to be developed*. It is difficult to envisage a method that will not require additional handling of animals with possible adverse effects; hopefully the proponents of this topic can prevent adverse effects.
- *Determination and identification of different prey species at different levels of maturity*. Given that the trawl fishery appears to still be taking significant numbers of smalltooth sawfish, it should be possible to arrange to retain gut samples from at least some of the animals that are dead when landed on board. This would supply information on diets without having to handle other animals.
- *Identification of preferred prey species during each life stage*. Why is this information needed and what methods could be used that would be non-invasive?
- *Research to determine whether potential exists for captive propagation*. Inevitably this means holding more smalltooth sawfish in captivity. I suspect that adequate protection of habitat and the existing population coupled with patience may be a more effective method. It would be pointless in breeding smalltooth sawfish if suitable habitat were not available for this expanding population.

Review Summary

Conclusions: The summary provided to the review is an accurate account of the material presented in the review. It does not make claims that are not substantiated by the review and the conclusion of the review team is justified:
After reviewing the best scientific and commercial information, the status review team has provided a convincing case that the continued existence of the U.S. DPS of smalltooth sawfish is in danger of extinction throughout all or a significant portion of its range from a combination of the following four listing factors: the present or threatened destruction, modification, or curtailment of habitat or range; over utilization for commercial recreational scientific or educational purposes; inadequacy of existing regulatory mechanisms; and other natural or manmade factors affecting its continued existence

References and Literature Cited

The list of references provided by the reviewers is most comprehensive. Although many of the references are of purely historical interest, it is of value to have such a complete list. Additional relevant references that could be added are the following:

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- Zorzi, G. 1997. *In litt.* to IUCN Species Survival Commission, Cambridge, UK.

Appendix

Bibliography of Materials provided by the Center for Independent Experts

1. Status Review of Smalltooth Sawfish (Pristis pectinata), December 2000.
A 48-page review having the following contents:

- Introduction
- Smalltooth Sawfish Status Review Team Members
- Life History and Biology
- Distribution and Abundance
- Distinct Vertebrate Population Segment
- Analysis of Listing Factors
- Present or Threatened Destruction, Modification, or Curtailment of Habitat or Range
- Over utilization for Commercial, Recreational, Scientific or Educational Purposes
- Competition, Predation or Disease
- An Analysis of Existing Regulatory Authorities, Laws and Policies and their Inadequacy to Protect Smalltooth Sawfish
- Other Natural or Manmade Factors affecting its Continued Existence
- Current Conservation Efforts
- Summary
- References and Literature Cited

2. Appendix A:
Existing smalltooth records (includes records for over 300 individuals and where the information is available, location, position, depth, number in record, size, sex, catalogue number and source). Record covers the period 1782 to 2000

3. Appendix B:
Florida landings data for recreational fishing showing CPUE data for smalltooth sawfish for 1989 – 1999 and numbers of smalltooth sawfish caught from each of six areas by year for 1989 – 1999 (includes 76 sawfish)

4. Appendix C:
NMFS records of smalltooth sawfish commercial landings for the period 1950 to 1978. Records include type of gear used, weight and value of catch.

5. Federal Register: April 16, 2001 (Volume 66, Number 73)
Proposed Rules
Page 19414-19420
From the Federal Register Online via GPO Access [wais.access.gpo.gov]
[DOCID:fr16ap01-14]
DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
50 CFR Part 224

[Docket No. 000303059-1019-02; I.D. No. 021700B]
RIN 0648-XA49
Endangered and Threatened Species; Proposed Endangered Status for a Distinct Population Segment of Smalltooth Sawfish (Pristis pectinata) in the United States
AGENCY: National Marine Fisheries Service (NMFS), National Oceanic and Atmospheric Administration (NOAA), Commerce.
ACTION: Proposed rule, notice of availability; request for comments.

STATEMENT OF WORK

Consulting Agreement Between The University of Miami and Dr. Burke Hill

December 9, 2003

General

The National Marine Fisheries Service was petitioned to list U.S. populations of smalltooth sawfish as an endangered species under the Endangered Species Act (ESA) on November 30, 1999. In order to conduct a comprehensive review of smalltooth sawfish, a status review team was created to investigate the status of the species with regard to the listing criteria provided by the ESA. In addition to its own resources and data, the status review team gathered all known records and data of smalltooth sawfish by contacting fishery managers, museums and other research collectors. The document addresses the status of the species, the five listing determination criteria, and the effect of efforts underway to protect the species. NMFS has accepted the findings of the status review and, on April 16, 2001, published a proposed rule to list smalltooth sawfish as an endangered species.

NMFS is required to use the best scientific and commercial information available in its ESA listing decisions, and has a policy of seeking peer review of its ESA status review documents. The current review of the smalltooth sawfish status review document will help ensure and confirm that the final listing decision is based on the best available information.

The consultant is expected to evaluate whether the smalltooth sawfish status review document and the proposed rule to list smalltooth sawfish properly use the best available scientific and commercial data. The consultant should identify important additional sources of information of which the consultant may be aware and provide critique and comments on the documents.

Specific

The consultant's duties shall not exceed a maximum total of four days, including reviewing background material and producing a written report of the findings. It is expected that the individual contribution of the consultant shall reflect the consultant’s area of expertise; therefore, no consensus opinion (or report) will be accepted. Specific tasks and timings are itemized below:

1. Read and become familiar with the relevant documents provided in advance to the consultant;

2. No later than August 13, 2001, submit a written report of findings, analysis, and conclusions. The report should be addressed to the "UM Independent System for Peer Reviews, " and sent to David Die, UM/RSMAS, 4600 Rickenbacker Causeway, Miami, FL 33149 (or via email to ddie@rsmas.miami.edu).

Signed_____*Burke Hill*_____
Date___*8 August 2001*_____

PRELIMINARY BUDGET

1. Salary (maximum of 4 days)	$2,000
2. Mailing costs	$100
TOTAL	$2,100

ANNEX I: REPORT GENERATION AND PROCEDURAL ITEMS

1. The report should be prefaced with an executive summary of findings and/or recommendations.

2. The main body of the report should consist of a background, description of review activities, summary of findings, and conclusions/recommendations.

3. The report should also include as separate appendices the bibliography of materials provided by the Center for Independent Experts and the center and a copy of the statement of work.

4. Individuals shall be provided with an electronic version of a bibliography of background materials sent to all reviewers. Other material provided directly by the center must be added to the bibliography that can be returned as an appendix to the final report.

Please refer to the following website for additional information on report generation: http://www.rsmas.miami.edu/groups/cimas/Report_Standard_Format.html